Exhibit 3

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

RESONANT SYSTEMS, INC. d/b/a RevelHMI, Plaintiff, v. SAMSUNG ELECTRONICS CO., LTD. and SAMSUNG ELECTRONICS AMERICA, INC., Defendants.	Case No. 2:22-cv-00423-JRG-RSP **JURY DEMANDED**

Expert Declaration of Richard Hooper, Ph.D., P.E.

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I. INTRODUCTION

1. I have been retained as an expert in this case by counsel for Resonant Systems, Inc. d/b/a RevelHMI ("RevelHMI"). I understand the parties dispute the meaning of certain claim terms. I have reviewed the intrinsic evidence and relevant extrinsic evidence relating to those terms and have relied upon such evidence in formulating my opinions. I have also relied upon my experience, education, and knowledge of the relevant art. In this declaration, I provide my opinions regarding how a person of ordinary skill in the art ("POSITA") would understand each disputed claim term, considering the viewpoint of a POSITA at the time of the invention.

2. I am being paid for my work on this matter on an hourly basis at $350/hour. My compensation is not contingent on my reaching any particular conclusions, or on any outcome in this matter. I have no financial interest in the outcome of this case.

II. QUALIFICATIONS

3. I am a licensed professional engineer and technical expert in the field of robotics, automation, and computer controlled machines. Briefly summarized below are my professional experiences, educational background, and other qualifications relevant to this matter. My curriculum vitae, attached as Ex. A, sets forth this experience and training in further detail. Additionally, I have been retained in dozens of matters as an expert witness regarding robotics, automation, and computer controlled machines.

4. I am a former Chief Engineer at Textron Systems, a former Principal Engineer at Eaton Corporation, and a former Chief Scientist at the University of Texas Robotics Research Group. My career has spanned over thirty-five years of industrial and research work in highly technical environments. This experience includes both hardware and software engineering roles in, among other areas, robotics, motion control, and human-machine interfaces. Over the years I have completed numerous technical projects with Fortune 500 companies and multiple federal agencies.

5. I am the author or coauthor of over thirty-five technical publications, the author of

five copyrighted software systems, a named inventor on three patents, a NASA Certificate of Merit recipient, C. Rowe Fellow, Registered Professional Engineer, three-time judge of R&D Magazine's Top 100 Developments, former member of the World Automation Congress Technical Committee and former Division X Professional Activities Chairman of the Institute of Electrical and Electronics Engineers (IEEE).

6. My training and education include an undergraduate degree in electrical engineering from Rice University, a master's degree in mechanical engineering from the University of Texas at Austin, and a PhD in robotics and automation, also from UT Austin. While at UT Austin, I taught graduate and undergraduate courses in robotics and automation, instrumentation and controls, and technical writing.

7. The patents at issue in this case detail Linear Vibration Modules (LVMs) and Linear-Resonant Vibration Modules (LRVMs) driven by feedback controllers to produce vibrational amplitude/frequency combinations throughout a large region of amplitude/frequency space.

8. During my career, I have designed feedback controllers for electro-mechanical actuators in robotic systems ranging in complexity from an elementary food packing machine with two actuators to a multi-armed robot designed for servicing the international space station that had dozens of actuators. The LVMs and LRVMs described in the patents at issue are examples of electro-mechanical actuators. This is readily apparent when one considers applications such as the foot massager shown in figures 24 and 25 of the patents.

9. Other applications for LVMs and LRVMs include mobile phones, vibration-driven appliances, such as hair-trimming appliances, electric toothbrushes, electric toy football games, and many other appliances, devices, and systems. In my experience, it is also not uncommon to find vibrating modules that produce haptic feedback in hand-held devices for remotely controlling robotic manipulator systems, though these have been rotational vibrating modules.

10. The patents at issue detail how LVMs and LRVMs inherently have a region of

amplitude/frequency space that is larger than that of unbalanced rotating motors and describe how the size of this space for LVMs and LRVMs can be increased even further by varying the natural frequencies of the modules. The patents include both a mechanical method (Figure 17) of varying natural frequency using an adjustment screw and an electromagnetic method (Figure 13) that varies the current through two electrical coils to change the natural frequency of the module. I have experience using similar methods of varying natural frequency in system design.

11. Since 2003, I have also provided technical consulting support for litigation matters, including intellectual property disputes. My work in this capacity has included, for example, reviewing and analyzing patents and source code, preparing expert reports, and providing expert testimony.

III. MATERIALS CONSIDERED FOR THIS DECLARATION

12. In forming my opinion, I have reviewed relevant portions of the asserted patents, their claims, and their prosecution histories, as well as the parties' preliminary claim construction disclosures and extrinsic evidence, and the materials cited in this declaration. I have also relied on my professional experience. I reserve the right to consider additional materials as I become aware of them, and to revise my opinions accordingly.

IV. UNDERSTANDING OF LEGAL PRINCIPLES

13. I understand that a claim construction inquiry begins and ends with the actual words of the claim. Apart from the written description and the prosecution history, the claims themselves provide substantial guidance as to the meaning of particular terms. I further understand that the context in which a term is used in the asserted claim can be highly instructive. The patent specification can also shed light on the meaning of claim terms.

14. I understand that, when conducting a claim construction inquiry, courts are not required to construe every limitation present in a patent's asserted claims. I further understand that where a term is used in accordance with its plain meaning, the court should not re-characterize it using different language.

15. I understand that there is a "heavy presumption" that claim terms carry their full ordinary and customary meaning unless the accused infringer can show that the patentee expressly relinquished claim scope. The ordinary and customary meaning of a claim term is the meaning that the term would have to a POSITA at the time of the invention.

16. I understand that courts generally do not import limitations into claims from examples or embodiments appearing only in a patent's written description, even when a specification describes very specific embodiments of the invention or even only a single embodiment. Similarly, I understand that statements during patent prosecution do not limit the claims unless the statement is a clear and unambiguous disavowal of claim scope.

17. I understand that Defendants in this action bear the burden of proving that a claim is indefinite by clear and convincing evidence. I understand that a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention.

18. I understand that, under 35 U.S.C. § 112(6), "[a]n element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof." 35 U.S.C. § 112(6). I understand that the standard for determining whether § 112(6) applies is whether the words of the claim are understood by persons of ordinary skill in the art to have a sufficiently definite meaning as the name for structure. Where a claim term lacks the word "means," there is a presumption that § 112(6) does not apply. To rebut this presumption, the challenger must demonstrate that the claim term fails to recite sufficiently definite structure or else recites function without reciting sufficient structure for performing that function. I understand this presumption cannot be overcome without showing that the claim limitation is devoid of anything that can be construed as a structure. I further understand that if § 112(6) does apply, then the corresponding structure should not be limited to the structure described for a

single embodiment in the specification if the patentee has disclosed multiple embodiments.

19. I understand that when a claim is subject to § 112(6) and it recites basic processor functions, the specification need not disclose corresponding algorithms because a standard microprocessor can provide sufficient structure for functions that can be achieved by any general purpose computer without special programming. If special programming is required to perform the claimed function, I understand that a corresponding algorithm can be expressed in the patent in any understandable terms, including as a mathematical formula, in prose, as a flow chart, or in any other manner that provides sufficient structure.

20. I understand that a typographical error in a patent claim can be corrected by the Court during claim construction, as long as the correction is not subject to reasonable debate based on the claim language and specification, and as long as the prosecution history does not suggest a different interpretation of the claim.

V. BACKGROUND OF THE PATENTED TECHNOLOGIES

21. I understand that there are two asserted patents in this action, namely U.S. Patent No. 9,369,081 ("'081 patent") and U.S. Patent No. 9,941,830 ("'830 patent"). The '830 patent is a continuation of the '081 patent and shares the same specification. I understand that claims 1-8 and 17 of each patent are asserted against Samsung.

22. The Abstract of the '081 patent explains, for example:

> The current application is directed to various types of linear vibrational modules, including linear-resonant vibration modules, that can be incorporated in a wide variety of appliances, devices, and systems to provide vibrational forces. The vibrational forces are produced by linear oscillation of a weight or member, in turn produced by rapidly alternating the polarity of one or more driving electromagnets. Feedback control is used to maintain the vibrational frequency of linear-resonant vibration module at or near the resonant frequency for the linear-resonant vibration module. Both linear vibration modules and linear-resonant vibration modules can be designed to produce vibrational amplitude/frequency combinations throughout a large region of amplitude/frequency space.

'081 patent at Abstract. Further background on the claimed inventions is provided in the specification, especially the portions referenced below in my analyses of the parties' claim

construction disputes.

VI. LEVEL OF ORDINARY SKILL IN THE ART

23. A POSITA at the time of the invention would have had (1) a bachelor's degree in electrical engineering, mechanical engineering, or a comparable field of study, and (2) at least two years of professional experience with electro-mechanical control systems, or other similarly relevant industry experience. Additional relevant industry experience may compensate for lack of formal education or vice versa. I qualified as a POSITA as of the earliest claimed priority date of the asserted patents, in May 2009. I also understand the capabilities of a POSITA at the relevant time because I was working with, managing, and providing technical direction to engineers with similar training and experience during that period.

24. I understand that Samsung has proposed that a POSITA would have had (1) a bachelor's degree in electrical engineering, mechanical engineering, computer science, or a similar field, and (2) two years of experience related to electronic consumer product design, with additional training substituting for educational or research experience, or vice versa. I understand Samsung further contended that a POSITA would have been familiar with various consumer products involving a vibrational component. My opinions herein would not change if the Court were to adopt that definition for the level of ordinary skill.

VII. AGREED CONSTRUCTIONS

25. I understand the parties agree to the following claim constructions:

Claim Term	Agreed Construction
Preamble ('081 and '830 Patents, claim 1)	The preamble is limiting.
"The [linear] vibration module of claim 1 wherein the control component is one of: an variable oscillator circuit with additional control circuitry; and a control component that includes a microprocessor, a control program, stored in an electronic memory within, or separate from, the	The limitation may be met either by a "variable oscillator circuit…" or by "a control component that includes a microprocessor…."

Claim Term	Agreed Construction
microprocessor, the control program executed by the microprocessor to control supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from [the user-input features/one or more stored values]" ('081 and '830 Patents, claim 2)	

VIII. DISPUTED CLAIM CONSTRUCTIONS

A. "vibration module" ('081 and '830 patents, claims 1-8, 17)

RevelHMI's Proposal	Samsung's Proposal
Plain and ordinary meaning	"**a vibration-generating device that can be incorporated in a wide variety of appliances, devices, and systems to provide vibrational forces**"

26. The phrase "vibration module" would be readily understood by a POSITA and jury. I see no need to construe this term and replace this simple two-word phrase with the 20-word phrase Samsung proposes.

27. Because Samsung's proposal also includes the word "vibration," it appears that Samsung agrees that "vibration" is readily understandable. The majority of Samsung's proposed language (i.e., everything after "a vibration-generating device") is quoted from the specification. *See, e.g.*, '081 patent at Abstract, 3:7-10. But this language is not a definition for "module," "vibration module," or anything else—nor is it a disclaimer of any kind. Instead, the specification simply states that it describes "various types of linear vibrational modules, including linear-resonant vibration modules, that can be incorporated in a wide variety of appliances, devices, and systems to provide vibrational forces." That is merely a description of how vibration modules can be used in practice (e.g., in commercial applications).

28. In my analysis, I also reviewed the two dictionary definitions of "module"

identified by Samsung in its disclosures (i.e., SAMRES_00053911-13 and SAMRES_00053926-28). Neither changes my opinion that the plain and ordinary meaning applies, and that Samsung is incorrect to suggest that the specification's description of how a vibration module can be used in practice must limit the scope of the "vibration module" claim term.

B. "frequency" ('081 patent, claims 1, 2, 5, 6, 17; '830 patent, claims 1-8, 17)

RevelHMI's Proposal	Samsung's Proposal
Plain and ordinary meaning	"**rate of oscillation**"

29. The word "frequency" would be readily understood by a POSITA and jury. I see no need to construe this term.

30. Samsung's proposed construction does not come from the specification, nor does it use language that would be more easily understood by a jury. In my opinion, it is more likely that a juror would be familiar with the term "frequency" than "oscillation." I am not aware of any special definition or disclaimer provided in the specification or prosecution history that would support Samsung's proposal.

31. In my analysis, I also reviewed the three dictionary definitions of "frequency" identified by Samsung in its disclosures (i.e., SAMRES_00053905-07, SAMRES_00053908-10-28, and SAMRES_00053914-16). None changes my opinion that the plain and ordinary meaning applies here. None of Samsung's dictionary definitions includes the phrase "rate of oscillation." Furthermore, none includes the word "rate" and only one includes a variant of the word "oscillation"), making it unclear why Samsung believes these dictionary definitions support its proposed construction.

C. Typographical error in claim 4 ('081 and '830 patents, claims 4, 5, 6)

Claim Term	RevelHMI's Proposal	Samsung's Proposal
"claim 1" ('081 and '830 patents, claim 4)	"**claim 3**"; not indefinite	Plain and ordinary meaning

Claim Term	RevelHMI's Proposal	Samsung's Proposal
"the one or more operational control outputs" ('081 and '830 patents, claims 4, 5, 6)	Plain and ordinary meaning; **not indefinite**	**Indefinite; no antecedent basis**
"the received output signals from the sensors" ('081 and '830 patents, claim 4)	Plain and ordinary meaning; **not indefinite**	**Indefinite; no antecedent basis**
"the sensors" / "the one or more sensors" ('081 and '830 patents, claim 4)	Plain and ordinary meaning; **not indefinite**	**Indefinite; no antecedent basis**

32. Claim 4 in each patent includes a simple typographical error that should be corrected. Instead of claim 4's preamble reciting "The [linear] vibration module of claim **1**," the preamble should have read "The [linear] vibration module of claim **3**." It is readily apparent from the claim language that this is a one-character typographical error, and the specification and prosecution history do not suggest any different interpretation.

33. In this sub-section, I have grouped together four claim construction disputes that all relate to this issue. In the first dispute, RevelHMI proposes that the typographical error be corrected (i.e., that "of claim 1" at the beginning of claim 4 be replaced with "of claim 3"). Samsung denies that this is a typographical error and thus argues that "claim 1" should not be corrected but instead should be applied as written. The reason why Samsung takes this position is apparent from the three other claim construction disputes listed in the above table. In short, Samsung argues that the phrase "claim 1" should not be corrected because leaving it as is generates three indefiniteness arguments for Samsung, all based on lack of antecedent basis. But the challenged phrases do have clear antecedent basis in claim 3, which demonstrates why Samsung is incorrect to suggest that there is not an obvious typographical error in claim 4's recitation of "claim 1."

34. A POSITA would easily recognize the one-character typographical error in the preamble of claim 4. While I believe a POSITA would not need for this typo to be corrected in order to understand claim 4, I understand that a typographical error in a patent claim can be corrected by the Court during claim construction. I further understand that (1) a correction

cannot be subject to reasonable debate in light of the claim language and specification, and (2) the prosecution history cannot suggest a different interpretation of the claim. As detailed below, I agree with RevelHMI that both requirements are met here.

35. Samsung's indefiniteness arguments illustrate clearly that there can be no reasonable debate that the preamble of claim 4 was intended to recite "The [linear] vibration module of claim 3." For example, claim 4 recites three phrases that are preceded by the word "the" but have no antecedent basis from earlier in claim 4 or from claim 1: (1) "the one or more operational control outputs," (2) "the received output signals from the sensors," and (3) "the [one or more] sensors." *See* '081 and '830 patents, cl. 4. Notably, I understand that Samsung does not dispute that claim 3 does indeed provide proper antecedent basis for all three of these phrases recited in claim 4. In other words, Samsung recognizes that if RevelHMI's proposed correction (i.e., the change of a single character from "claim 1" to "claim 3") were implemented, then Samsung's indefiniteness argument would have no grounds. Samsung's position requires the POSITA to believe that it would have been less likely that the patentee mistyped a single numeral in the preamble of claim 4 than it would have been for the patentee to introduce three new phrases in claim 4, all preceded by the definite article "the," without having antecedent basis for any of them. Samsung apparently believes the one-character typo is so much less likely to have happened that there is clear and convincing evidence that claims 4, 5, and 6 all must be held invalid for indefiniteness.

36. I disagree with Samsung. A single-character typo is a far more reasonable explanation for the lack of antecedent basis Samsung raises than the patentee rendering its own patent claim indefinite in three separate ways. As the accused infringer in this case, I understand that Samsung is motivated to invalidate claims in any way it can. But a POSITA lacking the same motivation would not set aside logic the way Samsung has. A POSITA would recognize that this is a simple typographical error, in which the patentee plainly intended to refer back to the immediately preceding claim providing clear antecedent basis for all of the phrases Samsung challenges as indefinite. Reading claims 3 and 4 together further illustrates this, given how claim

4 builds upon claim 3 with further limitations in claim 4 on the verb "adjusts" that is in both claims 3 and 4:

> 3. The linear vibration module of claim 1 wherein the control component receives output signals from sensors within the linear vibration module during operation of the linear vibration module and adjusts one or more operational control outputs of the control component according to the received output signals from the sensors.
>
> 4. The linear vibration module of claim 1 wherein the control component adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of the linear vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters.

'081 patent at cls. 3, 4; *see also id.* at 6:24-42 (describing how sensor output signals are received and used adjusting control outputs, consistent with the limitations of claims 3 and 4). For at least these reasons, it is my opinion that it is clear the patentee intended for claim 4 to depend from claim 3.

37. The prosecution histories of the '081 and '830 patents do not suggest any different interpretation. I have not identified anything in the intrinsic evidence that supports Samsung's interpretation, other than claim 4's recitation of "of claim 1" rather than "of claim 3." Again, a POSITA would recognize this as a one-character typographical error, and all intrinsic evidence I have found on this topic either supports that conclusion or is neutral on the subject.

D. "wherein the one or more operational control outputs is a control output that determines a current supplied by the power supply to the driving component and a frequency at which the control component drives the moveable component to [linearly] oscillate" ('081 and '830 patents, claim 6)

RevelHMI's Proposal	Samsung's Proposal
Plain and ordinary meaning	"wherein the one or more operational control outputs is a control output that determines a current supplied by the power supply to the driving component and **is** a frequency at which the control component drives the moveable component to [linearly] oscillate"

38. This claim term would be readily understood by a POSITA and jury. I see no need to construe this term.

39. I disagree with Samsung's proposal to add an "is" to this claim term. A POSITA would understand this claim term as "wherein the one or more operational control outputs is a control output that determines [1] a current supplied by the power supply to the driving component and [2] a frequency at which the control component drives the moveable component to [linearly] oscillate," which is the plain and ordinary meaning and makes grammatical sense. I understand Samsung proposes interpreting this term as "wherein the one or more operational control outputs [1] is a control output that determines a current supplied by the power supply to the driving component and [2] **is** a frequency at which the control component drives the moveable component to [linearly] oscillate." I disagree with Samsung's proposal to import a requirement that the control output itself must be a frequency. I am not aware of any intrinsic or extrinsic evidence that would require interpreting the claim language as Samsung proposes.

E. "tube" ('081 and '830 patents, claim 8)

RevelHMI's Proposal	Samsung's Proposal
Plain and ordinary meaning	"**cylindrical housing**"

40. The term "tube" would be readily understood by a POSITA and jury. I see no need to construe this term.

41. Samsung proposes to limit this term to only one type of tube, specifically a cylindrical tube. Although in some fields cylindrical tubes are more common than other types of tubes, a POSITA would readily recognize that rectangular tubes also exist and are in general use. As reflected in familiar dictionary definitions, a tube is "A hollow body, usually cylindrical, and long in proportion to its diameter, of wood, metal, glass, or other material, used to convey or contain a liquid or fluid, or for other purposes; a pipe" (Oxford English Dictionary, https://doi.org/10.1093/OED/4225591863), or "a long, hollow object that is used especially to control the flow of a liquid or gas" (Britannica, https://www.britannica.com/dictionary/tube), or

"a hollow, usually cylindrical body of metal, glass, rubber, or other material, used especially for conveying or containing liquids or gases" (Dictionary.com, https://www.dictionary.com/browse/tube). The scope of "tube" is not defined by cross-section but by other familiar properties known to both a POSITA and the jury, such as by being hollow and relatively narrow.

42. Furthermore, a POSITA would be readily familiar with tubes of square or rectangular cross-section made of metal or other materials, which are readily available from suppliers. For example, the Lowes.com section on "Tubes" features categories for "Square" and "Round" tubes (i.e., hollow cylinders and rectangular prisms, respectively), and in fact lists numerous "square" tubes before the first listing of a "round" tube. *See* https://www.lowes.com/pl/Tubes-Metal-rods- shapes-sheets-Hardware/2641124591. Therefore, especially in the context of constructing a mechanical device as claimed in Claim 8 of the '081 and '830 patents, a POSITA would recognize that "tube" does not necessarily refer to a cylindrical structure, but can also include tubes with square or rectangular cross-sections.

F. "moveable component" ('081 and '830 patents, claims 1, 2, 5-7, 17)

RevelHMI's Proposal	Samsung's Proposal
Plain and ordinary meaning; **not subject to 35 U.S.C. § 112 ¶ 6**. If subject to 35 U.S.C. § 112 ¶ 6, then: **<u>Function</u>**: moving **<u>Structures</u>**: A moving weight. E.g., '081 and '830 Patents, Figs 4A-4G (weight 404), Fig. 6 (oscillating mass 634), Fig. 11 (moving mass 1102), Fig. 12 (moving mass with additional coils 1202 and 1204), Fig. 13 (moving mass/weight 1306), Fig. 14 (driving magnet 1406), Figs. 15, 16 (magnets 1506, 1508); and equivalents thereof	**Subject to 35 U.S.C. 112 ¶ 6**. **<u>Function</u>**: moving **<u>Structures</u>**: A moving weight. E.g., '081 and '830 Patents, Figs 4A-4G (weight 404), Fig. 6 (oscillating mass 634), Fig. 11 (moving mass 1102), Fig. 12 (moving mass with additional coils 1202 and 1204), Fig. 13 (moving mass/weight 1306), Fig. 14 (driving magnet 1406), Figs. 15, 16 (magnets 1506, 1508)

43. The phrase "moveable component" would be readily understood by a POSITA

and jury. I agree with RevelHMI that there is no need to construe this term.

44. I understand that "moveable component" is presumed to be not subject to 35 U.S.C. § 112(6) because it does not include the word "means." In my opinion, Samsung cannot overcome this presumption because it cannot demonstrate that "moveable component" fails to recite sufficiently definite structure or else recites function without reciting sufficient structure for performing that function. The claims do not require the moveable component to perform any particular function—the claims merely require that it be moveable and describe circumstances that would cause it to be moved. Given this context, a POSITA would understand "moveable component" to be a structural term. I do not see how Samsung can overcome the presumption that 35 U.S.C. § 112(6) does not apply.

45. However, if the Court determines that this claim term is subject to 35 U.S.C. § 112(6), then I support RevelHMI's description of the corresponding function and structure. The parties agree (as do I) that the function of the "moveable component" is moving. The parties' identifications of corresponding structure also match, except that Samsung does not explicitly state that the corresponding structure includes equivalents of the disclosed structure. I understand that 35 U.S.C. § 112(6) specifically refers to "equivalents thereof," so Samsung is presumably not seeking to exclude equivalents when it does not explicitly refer to "and equivalents thereof" here and with respect to other terms allegedly subject to 35 U.S.C. § 112(6). Otherwise, I agree with the parties' identification of structures for performing the agreed function.

G. "driving component that drives the moveable component [in each of two opposite directions/to oscillate] within the housing" ('081 and '830 patents, claim 1)

RevelHMI's Proposal	Samsung's Proposal
Subject to 35 U.S.C. § 112 ¶ 6. **<u>Function</u>**: driving the moveable component [in each of two opposite directions/to oscillate] within the housing	Subject to 35 U.S.C. 112 ¶ 6 **<u>Function</u>**: driving the moveable component [in each of two opposite directions/to oscillate] within the housing

RevelHMI's Proposal	Samsung's Proposal
Structures: One or more **coils or electromagnets**. E.g., '081 and '830 Patents, Figs 4A-4G (coil 420), Fig. 5A (coil 514), Fig. 6 (coil 626), electromagnet of Fig. 10, electromagnet of Fig. 11, Fig. 12 (coil 1206), Fig. 13 (first coil 1302 and second coil 1304), Fig. 14 (coils 1412 and 1414), Figs. 15, 16 (coil 1510), stator coils of Figures 24A, 24B, and 25; and equivalents thereof	**Structures**: One or more **electromagnetic coils**. E.g., '081 and '830 Patents, Figs 4A-4G (coil 420), Fig. 5A (coil 514), Fig. 6 (coil 626), electromagnet of Fig. 10, electromagnet of Fig. 11, Fig. 12 (coil 1206), Fig. 13 (first coil 1302 and second coil 1304), Fig. 14 (coils 1412 and 1414), Figs. 15, 16 (coil 1510), stator coils of Figures 24A, 24B, and 25

46. Assuming that 35 U.S.C. § 112(6) applies to this claim term, I support RevelHMI's description of the corresponding structure for this claim term and note that both parties agree (as do I) that the function of the "driving component" is driving the moveable component [in each of two opposite directions/to oscillate] within the housing. Samsung also agrees with RevelHMI's identification of exemplary corresponding structures. I also support RevelHMI's description of the corresponding structure as one or more "coils or electromagnets" because that is more consistent with the language of the specification examples referenced by the parties, which refer to coils and electromagnets.

H. "control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features" ('081 patent, claim 1)

RevelHMI's Proposal	Samsung's Proposal
Subject to 35 U.S.C. § 112 ¶ 6. **Function**: controlling supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features **Structures**: **oscillator circuit; microcontroller with internal or external memory;** processor; **CPU; microprocessor;** and equivalents thereof	Subject to 35 U.S.C. 112 ¶ 6. **Function**: controlling supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features **Structures**: **Processor** programmed with an algorithm to perform the following steps: (1) set the mode and strength to values **represented by** selections made by user

RevelHMI's Proposal	Samsung's Proposal
[if an algorithm is required] Where the corresponding structure is a processor, CPU, or microprocessor, the processor/CPU/microprocessor is programmed with an algorithm comprising the following steps: (a) set the mode and strength to values **representing** selections made by user input to the user input features; and (b) provide a corresponding output to the power supply **so that the power supply provides a corresponding output to the driving component** *See, e.g.*, '081 patent at 7:10-24, 8:10-20, Figs. 7A, 7C	input to the user input features, (2) provide a corresponding output to the power supply, and **(3) provide a corresponding output to the driving component**. '081 Patent at 7:10-24, 8:10-20, Figs. 7A, 7C.

47. Assuming that 35 U.S.C. § 112(6) applies to this claim term, I support RevelHMI's description of the corresponding function and structure. The parties agree (as do I) that the function of the "control component" is controlling supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features.

48. Samsung also partly agrees with RevelHMI's identification of corresponding structures, except that Samsung incorrectly limits the disclosed structure to only a "processor." It is unclear whether Samsung's identification of "processor" is intended to encompass "processor," "microprocessor," and "CPU," all of which are referred to in the specification. *See, e.g.*, '081 patent at 3:45-49, 5:66-8:30, 10:53-11:3, 11:43-58, 12:36-13:51, 14:60-64, Figs. 6, 7A, 7B, 7C. Because "microprocessor" and "CPU" are described in the specification as performing the claimed function, those should be included in any identification of corresponding structures—as RevelHMI proposes. In addition, the specification discloses still other structures for performing the claimed function. For example, Samsung omits from its definition the oscillator circuit and microcontroller described in the specification:

As discussed above with reference to FIG. 6, including a processor or **microcontroller** within a linear-resonant vibration module allows for a very large number of different processor-controlled vibration patterns and modes to be exhibited by the linear-resonant vibration module. As discussed above, processor control along with a linear-resonant-vibration-module architecture allows the processor-controlled device to access a much larger portion of a total amplitude/frequency space than can be accessed by currently available unbalanced-electric-motor vibration devices. Thus, processor-controlled linear-resonant vibration modules provide a large increase in functionality with respect to currently available vibration modules. There is, however, a relatively large gap in functionality between processor-controlled linear-resonance vibration modules and currently available unbalanced-electric-motor vibration modules that can be bridged by linear vibration modules that lack processor or microprocessor control.

* * *

Alternative, lower-cost linear-vibration modules can be designed and manufactured by replacing the processor or **microcontroller** (602 in FIG. 6) of the above-described linear-resonant vibration module with a simpler **oscillator circuit** with additional control circuitry. The H switch (620 in FIG. 6) can be controlled by an oscillating current input rather than digital outputs from a microprocessor. Replacing the CPU or microprocessor with an oscillator and additional simple control circuitry produces a less functional, generally lower-Q, but also more economical linear vibration module that, although lacking the extremely broad range of vibration patterns and modes available to processor or microprocessor-controlled vibration modules, can nonetheless access a much larger portion of the amplitude/frequency space than can be accessed by currently available fixed-amplitude or fixed-frequency vibration modules.

In one example implementation of an oscillator-controlled linear vibration module, a variable-frequency **oscillator circuit** can be controlled by user input to drive the H switch or other H-switch-like circuit to operate the linear vibration module at different frequencies. A user is provided an input feature that allows the user to directly adjust the frequency of the variable oscillator and thus the vibrational frequency produced by the linear vibration module. The user is additionally provided with an input feature to allow the user to control the current or duty cycle used to drive the linear vibration module and to thus increase and decrease the amplitude of vibration produced by the linear vibration module. Thus, a user can control both the frequency of vibration and the amplitude of vibration.

FIG. 20 illustrates portions of amplitude/frequency space accessible to various types of vibration modules. … A processor or **microcontroller**-controlled linear-resonant vibration module, as discussed above with reference to FIGS. 4A-18, can access an even larger region of amplitude/frequency space that includes region **2010** with a subspace.

In certain low-Q linear vibration modules that lack microprocessor or

> **microcontroller** control, for any given frequency of operation, the amplitude tends to increase with decreasing frequency of operation. FIG. 21 illustrates the dependence between frequency and amplitude in a low-Q linear vibration module as well as a modified dependence that can be obtained by control circuitry. In FIG. 21, solid curve **2102** represents the dependence of amplitude on frequency for a low-Q linear vibration module without additional control circuitry. As the frequency decreases, the amplitude begins to steeply and non-linearly increase. In certain applications, a constant or relatively constant amplitude is desired over a broad range of frequencies. A low-Q linear vibration module without microprocessor or **microcontroller** control can obtain a more constant amplitude over a broader range of frequencies by adjusting the current or duty cycle downward at lower frequencies. …
>
> Returning to microprocessor-controlled or **microcontroller**-controlled linear vibration modules, it should be noted that processor or microprocessor control allows for an essentially limitless number of different vibrational behaviors and modes to be configured by software or firmware design, by user input, or by a combination of software or firmware design and user input. Rather simple enhancements can produce interesting enhanced vibrational behavior. As one example, a microprocessor-controlled or **microcontroller**-controlled linear vibration module can be programmed to drive the device simultaneously at two different frequencies. … By varying the number, relative amplitudes, and frequencies of two or more driving signals, a microprocessor-controlled or **microcontroller**-controlled linear-resonance vibration module can be controlled to produce any number of complex vibrational patterns and modes, including periodic modes, modes with multiple different periods, various modulated vibration modes, and even fully aperiodic vibration modes that do not repeat time.
>
> In a linear-resonant vibration module, discussed above, by maintaining device operation at a resonant frequency, the linear-resonant vibration module is a relatively high-Q device, and generally operates more efficiently to produce a given vibration amplitude than a low-Q device, such as a linear vibration module lacking microprocessor or **micro-controller** control and operating at a frequency/amplitude setting that does not correspond to a natural vibration mode of the device. There are, in addition, many other ways to increase the energy efficiency of a linear vibration module.

’081 patent at 10:53-13:51 (emphasis added); *see also* ’081 patent at 14:60-64 (“Any of various different microprocessors and other microcontrollers can be used in alternative embodiments of the LRVM ….”). I also note that claim 2 recites that the control component of claim 1 can be an oscillator circuit, which is consistent with RevelHMI’s proposal. For the reasons detailed above, I disagree with Samsung’s exclusion of the oscillator circuit, microcontroller, microprocessor,

and CPU disclosed structures from its identification of corresponding structures under 35 U.S.C. § 112(6).

49. I also understand that if the specification discloses a general-purpose computer performing the claimed function, then the Court may require disclosure of an algorithm used for performing the claimed function. At most, only the disclosed "processor," "microprocessor," and "CPU" should be considered such general-purpose computers. A POSITA would not understand the disclosed microcontroller or oscillator circuit to be such general-purpose computers because they provide functionality more specifically relating to the claimed inventions—not just general computer functionality unrelated to the claimed inventions. Thus, it is my opinion that the specification need not disclose any algorithm for the microcontroller and oscillator circuit corresponding structures.

50. With respect to the disclosed "processor," "microprocessor," and "CPU," I understand that the algorithm for performing the claimed function can be expressed in the patent in any understandable terms, including as a mathematical formula, in prose, as a flow chart, or in any other manner that provides sufficient structure.

51. To the extent an algorithm is required, the parties partly agree as to what that algorithm should be. I agree with RevelHMI's proposed algorithm, which includes step (a) that nearly matches Samsung's step 1. However, I disagree with Samsung's "represented by" language and agree with RevelHMI that this should be replaced by "representing" for greater clarity. As to step (b), the first portion of RevelHMI's proposed step (b) matches Samsung's step 2 but also adds "so that the power supply provides a corresponding output to the driving component." Samsung proposes an additional step 3 that uses somewhat similar language, but as written it is inconsistent with the specification. Specifically, Samsung's step 3 would apparently require ***the processor*** to "provide a corresponding output to the driving component." But it is not the processor (or microprocessor or CPU) that provides an output to the driving component; instead, the processor provides an output to the power supply, which in turn provides an output to the driving component. *E.g.*, '081 patent at 8:16-20 ("Next, in step 762, the routine "control

computes an output value p corresponding to the currently selected strength, stored in the variable strength, and outputs the value p to the power supply so that ***the power supply*** outputs an appropriate current to the coil." (emphasis added)). To the extent Samsung's proposal would require the processor to provide an output directly to the driving component, that would not be consistent with the specification.

I. "control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by one or more stored values" ('830 patent, claim 1)

RevelHMI's Proposal	Samsung's Proposal
Subject to 35 U.S.C. 112 ¶ 6. **Function**: controlling supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features **Structures**: **oscillator circuit; microcontroller with internal or external memory;** processor; **CPU; microprocessor;** and equivalents thereof [if an algorithm is required] Where the corresponding structure is a processor, CPU, or microprocessor, the processor/CPU/microprocessor is programmed with an algorithm comprising the following steps: (a) set the mode and strength to default values or values **representing** selections made by user input to the user input features; and (b) provide a corresponding output to the power supply **so that the power supply provides a corresponding output to the driving component** *See, e.g.*, '830 patent at 7:20-34, 8:20-30, Figs. 7A, 7C	Subject to 35 U.S.C. 112 ¶ 6. **Function**: controlling supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by one or more stored values **Structures**: **Processor** programmed with an algorithm to perform the following steps: (1) set the mode and strength to default values or values **represented by** selections made by user input to the user input features, (2) provide a corresponding output to the power supply, and **(3) provide a corresponding output to the driving component**. '830 Patent at 7:20-34, 8:20-30, Figs. 7A, 7C.

52. For the reasons described above with respect to the immediately preceding disputed term (i.e., the "control component" term of '081 claim 1), I support RevelHMI's proposal and disagree with Samsung's proposal for this "control component" claim term of claim 1 of the '830 patent.

J. "wherein the control component receives output signals from sensors within the [linear] vibration module during operation of the [linear] vibration module and adjusts one or more operational control outputs of the control component according to the received output signals from the sensors" ('081 and '830 patents, claim 3)

RevelHMI's Proposal	Samsung's Proposal
Subject to 35 U.S.C. 112 ¶ 6. **Function**: receiving output signals from sensors within the [linear] vibration module during operation of the [linear] vibration module and adjusting one or more operational control outputs of the control component according to the received output signals from the sensors **Structures**: **oscillator circuit; microcontroller with internal or external memory;** processor; **CPU; microprocessor;** and equivalents thereof [if an algorithm is required] Where the corresponding structure is a processor, CPU, or microprocessor, the processor/CPU/microprocessor is programmed with an algorithm comprising the following steps: **(a) receive the value of an output signal; (b) compare that value to a different value, which could be a previous value**; and (c) adjust one or more operational control outputs based on that comparison *See, e.g.*, '081 patent at 7:13-18, 7:32-8:9, Figs. 7A, 7B; '830 patent at 7:23-28, 7:42-8:19, Figs. 7A, 7B	Subject to 35 U.S.C. 112 ¶ 6. **Function**: receiving output signals from sensors within the [linear] vibration module during operation of the [linear] vibration module and adjusting one or more operational control outputs of the control component according to the received output signals from the sensors **Structures**: **Claim 1 structure with the processor further programmed with an algorithm to perform the following steps: (1) convert the received output signal into an integer, (2) compare that integer to a specific value, (3) adjust one or more operational control outputs based on that comparison**. '081 Patent, 7:13-18, 7:32-8:9, Figs. 7A, 7B; '830 Patent, 7:23-29, 7:42-8:19, Figs. 7A, 7B.

53. Assuming that 35 U.S.C. § 112(6) applies to this claim term, I support RevelHMI's description of the corresponding function and structure. The parties agree on the claimed function, namely that the control component receives output signals from sensors within the [linear] vibration module during operation of the [linear] vibration module and adjusts one or more operational control outputs of the control component according to the received output signals from the sensors.

54. RevelHMI partly agrees (as do I) with Samsung's identification of corresponding structures, though Samsung incorrectly limits the disclosed structure to only a "processor." It is unclear to me whether Samsung's identification of "processor" is intended to encompass "processor," "microprocessor," and "CPU," all of which are referred to in the specification. *See, e.g.*, '081 patent at 3:45-49, 5:66-8:30, 10:53-11:3, 11:43-58, 12:36-13:51, 14:60-64, Figs. 6, 7A, 7B, 7C. Because "microprocessor" and "CPU" are described in the specification as performing the claimed function, those should be included in any identification of corresponding structures—as RevelHMI proposes. In addition, the specification discloses still other structures for performing the claimed function. For example, Samsung omits from its definition the oscillator circuit and microcontroller described in the specification, as further described above with respect to the "control component" limitation of claim 1. *See, e,g.*, '081 patent at 10:53-13:51, 14:60-64. I also note that claim 2 recites that the control component of claim 1 can be an oscillator circuit, which is consistent with RevelHMI's proposal. I disagree with Samsung's exclusion of the oscillator circuit, microcontroller, microprocessor, and CPU disclosed structures from its identification of corresponding structures under 35 U.S.C. § 112(6).

55. I understand that if the specification discloses a general-purpose computer performing the claimed function, then the Court may require disclosure of an algorithm used for performing the claimed function. At most, only the disclosed "processor," "microprocessor," and "CPU" should be considered such general-purpose computers. A POSITA would not understand the disclosed microcontroller or oscillator circuit to be such general-purpose computers because they provide functionality more specifically relating to the claimed inventions—not just general

computer functionality unrelated to the claimed inventions. Thus, it is my opinion that the specification need not disclose any algorithm for the microcontroller and oscillator circuit corresponding structures.

56. With respect to the disclosed "processor," "microprocessor," and "CPU," I understand that the algorithm for performing the claimed function can be expressed in the patent in any understandable terms, including as a mathematical formula, in prose, as a flow chart, or in any other manner that provides sufficient structure.

57. To the extent an algorithm is required, the parties partly agree as to what that algorithm should be. I agree with RevelHMI's proposed algorithm, which includes three steps. RevelHMI's step (c) matches Samsung's step 3, consistent with the specification. However, I disagree with certain portions of Samsung's steps 1 and 2. Samsung seeks to require that the processor convert an output signal into an integer and then compare that integer to a specific value. But that is not necessary for performing the claimed function of receiving output signals from sensors within the [linear] vibration module during operation of the [linear] vibration module (e.g., because the output signal could already be an integer and not require any conversion). Furthermore, there is no requirement that values be represented as integers in order to compare them. I agree with RevelHMI that receiving an output signal, storing its value in a variable, and comparing that variable to a value is sufficient for performing the claimed function. The output signal need not be converted to an integer to accomplish the function.

K. "wherein the control component adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of the [linear] vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters" ('081 and '830 patents, claim 4)

RevelHMI's Proposal	Samsung's Proposal
Subject to 35 U.S.C. 112 ¶ 6. **Function**: adjusting the one or more operational control outputs of the control	Subject to 35 U.S.C. 112 ¶ 6. **Function**: adjusting the one or more operational control outputs of the control

RevelHMI's Proposal	Samsung's Proposal
component according to the received output signals from the sensors in order that subsequent operation of the [linear] vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters **<u>Structures</u>**: Same structure as described above with respect to claim 3.	component according to the received output signals from the sensors in order that subsequent operation of the [linear] vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters **<u>Structures</u>**: Claim 1 structure with the processor further programmed with the same claim 3 algorithm.

58. Assuming that 35 U.S.C. § 112(6) applies to this claim term, I support RevelHMI's description of the corresponding function and structure. The parties agree on the claimed function, namely that the control component adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of the [linear] vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameter.

59. The parties also agree that the corresponding structure of claim 3 is the same as the corresponding structure of claim 4. However, as described above, I disagree with certain aspects of Samsung's proposed structure for claim 3. My analysis described above with respect to claim 3 also applies here with respect to claim 4.

L. "wherein the one or more operational control parameters is a strength of vibration produced by the [linear] oscillation of the moveable component; and wherein the one or more operational control outputs is a frequency at which the control component drives the moveable component to [linearly] oscillate, the control component dynamically adjusting the power supplied to the driving component to produce [linear] oscillation of the movable component at a resonant frequency for the linear vibration module" ('081 and '830 patents, claim 5)

RevelHMI's Proposal	Samsung's Proposal
Subject to 35 U.S.C. § 112 ¶ 6. **<u>Function</u>**: dynamically adjusting the power supplied to the driving component to produce	Subject to 35 U.S.C. 112 ¶ 6. **<u>Function</u>**: **Claim 4 function wherein the one or more operational control**

RevelHMI's Proposal	Samsung's Proposal
[linear] oscillation of the movable component at a resonant frequency for the [linear] vibration module **Structures**: **oscillator circuit; microcontroller with internal or external memory;** processor; **CPU; microprocessor;** and equivalents thereof [if an algorithm is required] Where the corresponding structure is a processor, CPU, or microprocessor, the processor/CPU/microprocessor is programmed with an algorithm comprising the following steps: **(a) if the frequency at which the device operates has been increasing and the vibrational force is greater than the previously sensed vibrational force, then increase the frequency—otherwise if the vibrational force is less than the previously sensed vibrational force, then decrease the frequency; and (b) if the frequency at which the device operates has not been increasing and the vibrational force is greater than the previously sensed vibrational force, then decrease the frequency—otherwise if the vibrational force is less than the previously sensed vibrational force, then increase the frequency** *See, e.g.*, '081 patent at 7:38-42, 7:50-8:9, Fig. 7B; '830 patent at 7:48-52, 7:60-8:19, Fig. 7B	**parameters is a strength of vibration produced by the [linear] oscillation of the moveable component; and wherein the one or more operational control outputs is a frequency at which the control component drives the moveable component to [linearly] oscillate, the control component** dynamically adjusting the power supplied to the driving component to produce [linear] oscillation of the movable component at a resonant frequency for the [linear] vibration module **Structures**: **Claim 1 structure with the processor further programmed according to the "default" algorithm illustrated in Figure 7B which comprises the following steps: (1) storing sensor input representing the current vibrational force in a variable; (2) checking a previously set variable to determine if the rate of oscillation of the movable component is increasing; (3) if the rate of oscillation of the movable component is increasing and the vibrational force is greater than the previously measured vibrational force, increasing the rate of oscillation of the movable component, otherwise decreasing the rate of oscillation of the movable component; and (4) if the rate of oscillation of the movable component is not increasing and the vibrational force is greater than the previously measured vibrational force, decreasing the rate of oscillation of the movable component, otherwise increasing the rate of oscillation of the movable component**. '081 Patent, 7:38-42, 7:50-8:9, Fig. 7B; '830 Patent, 48-52, 7:60-8:19, Fig. 7B.

60. Assuming that 35 U.S.C. § 112(6) applies to this claim term, I support RevelHMI's description of the corresponding function and structure. RevelHMI partly agrees (as

do I) with Samsung's identification of the claimed function, namely that the control component dynamically adjusts the power supplied to the driving component to produce [linear] oscillation of the movable component at a resonant frequency for the [linear] vibration module. But Samsung additionally includes two "wherein" clauses describing operational control parameters and operational control outputs. I disagree that these should be included in the claimed function because they do not recite additional function for the control component to perform. The first wherein clause does not even refer to the control component. The second wherein clause only refers to the control component where it states "at which the control component drives the moveable component to [linearly] oscillate." In the '081 patent, claim 1 (from which claim 6 depends) already recites "a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate" and specifies in the preamble of claim 1 a "linear vibration module." '081 patent at cl. 1. Similarly, claim 1 of the '830 patent recites "a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate." '830 patent at cl. 1. In other words, claim 1 already refers to the control component driving the moveable component to oscillate, such that this second wherein clause does not supply any additional function of "control component."

61. RevelHMI partly agrees (as do I) with Samsung's identification of corresponding structures, though Samsung incorrectly limits the disclosed structure to only a "processor." It is unclear whether Samsung's identification of "processor" is intended to encompass "processor," "microprocessor," and "CPU," all of which are referred to in the specification. *See, e.g.*, '081 patent at 3:45-49, 5:66-8:30, 10:53-11:3, 11:43-58, 12:36-13:51, 14:60-64, Figs. 6, 7A, 7B, 7C. Because "microprocessor" and "CPU" are described in the specification as performing the claimed function, those should be included in any identification of corresponding structures—as RevelHMI proposes. In addition, the specification discloses still other structures for performing the claimed function. For example, Samsung omits from its definition the oscillator circuit and microcontroller described in the specification, as further described above with respect to the

"control component" limitation of claim 1. *See, e,g.*, '081 patent at 10:53-13:51, 14:60-64. I also note that claim 2 recites that the control component of claim 1 can be an oscillator circuit, which is consistent with RevelHMI's proposal. I disagree with Samsung's exclusion of the oscillator circuit, microcontroller, microprocessor, and CPU disclosed structures from its identification of corresponding structures under 35 U.S.C. § 112(6).

62. I understand that if the specification discloses a general-purpose computer performing the claimed function, then the Court may require disclosure of an algorithm used for performing the claimed function. At most, only the disclosed "processor," "microprocessor," and "CPU" should be considered such general-purpose computers. A POSITA would not understand the disclosed microcontroller or oscillator circuit to be such general-purpose computers because they provide functionality more specifically relating to the claimed inventions—not just general computer functionality unrelated to the claimed inventions. Thus, it is my opinion that the specification need not disclose any algorithm for the microcontroller and oscillator circuit corresponding structures.

63. With respect to the disclosed "processor," "microprocessor," and "CPU," I understand that the algorithm for performing the claimed function can be expressed in the patent in any understandable terms, including as a mathematical formula, in prose, as a flow chart, or in any other manner that provides sufficient structure.

64. To the extent an algorithm is required, the parties partly agree as to what that algorithm should be. I agree with RevelHMI's proposed algorithm, which includes two steps, (a) and (b), which are very similar to steps 3 and 4 of Samsung's proposed algorithm. However, Samsung's version includes extraneous language that is not needed to accomplish the claimed function, and Samsung's version also incorporates its proposed construction of frequency, which I disagree with for the reasons described above with respect to the construction of that claim term. I also disagree with Samsung's inclusion of steps 1 and 2 in its proposed algorithm because they are not needed to accomplish the claimed function of "dynamically adjusting...." Samsung may have included these additional steps to address the language of the two "wherein" clauses

included in Samsung's proposed function, but I disagree with including those clauses in the claimed function for the reasons described above.

M. "wherein the one or more operational control parameters include both a strength of vibration produced by the linear oscillation of the moveable component and a current operational mode; and wherein the one or more operational control outputs is a control output that determines a current supplied by the power supply to the driving component and a frequency at which the control component drives the moveable component to [linearly] oscillate" ('081 and '830 patents, claim 6)

RevelHMI's Proposal	Samsung's Proposal
Plain and ordinary meaning; **not subject to 35 U.S.C. § 112 ¶ 6; not indefinite**. If subject to 35 U.S.C. § 112 ¶ 6 and Samsung's function is accepted, then: **Structures**: **oscillator circuit; microcontroller with internal or external memory; processor; CPU; microprocessor; and equivalents thereof** [if an algorithm is required] **Where the corresponding structure is a processor, CPU, or microprocessor, the processor/CPU/microprocessor is programmed with an algorithm comprising the following steps: (a) set the mode and strength to [default values or] values representing selections made by user input to the user input features; and (b) provide a corresponding output to the power supply so that the power supply provides a corresponding current to the driving component** '081 patent at 7:10-24, 8:10-20, Figs. 7A, 7C; '830 patent at 7:20-34, 8:20-30, Figs. 7A, 7C	**Subject to 35 U.S.C. 112 ¶ 6**. **Function**: Claim 4 function wherein the one or more operational control parameters include both a strength of vibration produced by the [linear] oscillation of the moveable component and a current operational mode; and wherein the one or more operational control outputs is a control output that determines a current supplied by the power supply to the driving component and a frequency at which the control component drives the moveable component to [linearly] oscillate. **Structures**: **Indefinite**.

65. This claim term would be readily understood by a POSITA and jury. I agree with RevelHMI that there is no need to construe this term.

66. I understand that Samsung believes that 35 U.S.C. § 112(6) applies to this term

because it recites function performed by the "control component." I disagree. I understand this claim term is presumed to be not subject to 35 U.S.C. § 112(6) because it does not include the word "means." In my opinion, Samsung cannot overcome this presumption because this term does not any additional function that would warrant application of 35 U.S.C. § 112(6). For example, "control component" is not even mentioned until the last few words of the claim term, where it recites "at which the control component drives the moveable component to [linearly] oscillate." In the '081 patent, claim 1 (from which claim 6 depends) already recites "a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate" and specifies in the preamble of claim 1 a "linear vibration module." '081 patent at cl. 1. Similarly, claim 1 of the '830 patent recites "a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate." '830 patent at cl. 1. In other words, claim 1 already refers to the control component driving the moveable component to oscillate, such that 35 U.S.C. § 112(6) does not apply to this term because it does not supply any additional function of "control component."

67. Nonetheless, if the Court were to decide that 35 U.S.C. § 112(6) does apply and also accepted Samsung's characterization of the claimed function (with which I would disagree), then the corresponding structures would be the same structures described above with respect to claims 1 and 4 (from which claim 6 depends), including equivalents thereof.

68. Samsung argues that the specification does not disclose any corresponding structure for the function it identifies, making claim 6 indefinite. I disagree. As described above with respect to claims 1 and 4, the specification discloses an oscillator circuit, microcontroller with internal or external memory, processor, CPU, and/or microprocessor corresponding to the claimed control component. *See, e.g.*, '081 patent at 3:45-49, 5:66-8:30, 10:53-13:51, 14:60-64, Figs. 6, 7A, 7B, 7C.

69. I understand that if the specification discloses a general-purpose computer performing the claimed function, then the Court may require disclosure of an algorithm used for

performing the claimed function. At most, only the disclosed "processor," "microprocessor," and "CPU" should be considered such general-purpose computers. A POSITA would not understand the disclosed microcontroller or oscillator circuit to be such general-purpose computers because they provide functionality more specifically relating to the claimed inventions—not just general computer functionality unrelated to the claimed inventions. Thus, it is my opinion that the specification need not disclose any algorithm for the microcontroller and oscillator circuit corresponding structures.

70. With respect to the disclosed "processor," "microprocessor," and "CPU," I understand that the algorithm for performing the claimed function can be expressed in the patent in any understandable terms, including as a mathematical formula, in prose, as a flow chart, or in any other manner that provides sufficient structure.

71. To the extent an algorithm is required, I agree with RevelHMI's proposed algorithm, which includes (a) setting the mode and strength to [default values or] values representing selections made by user input to the user input features, and (b) providing a corresponding output to the power supply so that the power supply provides a corresponding current to the driving component. This is consistent with my analysis described above with respect to claim 1. *See* analysis and evidence described above with respect to the "control component" limitation of claim 1; '081 patent at 7:10-24, 8:10-20, Figs. 7A, 7C; '830 patent at 7:20-34, 8:20-30, Figs. 7A, 7C.

I declare under penalty of perjury that the foregoing is true and correct.

Executed December 7, 2023.

By: ______________________

Richard Hooper, PhD, PE

EXHIBIT A

Richard Hooper, Ph.D., P.E.

1102 Bowie Rd. Austin, TX 78733

SUMMARY

- Technical architect of multi-million dollar projects with Fortune 500 companies and Federal agencies including: NASA, Merck, Medtronics, Guidant, Whirlpool, Michelin, Raytheon, Lockheed Martin, Northrop Grumman, US Air Force, US Army and US DOE
- Former Chief Engineer at Textron Systems, Electronic Systems Division
- Former Chief Scientist at the University of Texas Robotics Research Group
- Former Principal Engineer at Eaton Corporation
- Extensive experience and training in software, hardware, automation and instrumentation
- Over 35 years of industrial and research experience in highly technical environments
- Author of over 35 technical publications and government reports
- Author and developer of five copyrighted software systems

AWARDS AND PROFESSIONAL

NASA Certificate of Merit, World Automation Congress Technical Committee, R&D Magazine Top 100 Developments Judge, C. Rowe Fellow, Tau Beta Pi, IEEE Division X Professional Activities Chairman, National Instruments Test Leadership Council, Registered Professional Engineer

SOFTWARE

Oracle, SQL Server, SQL, C/C++, LISP, .NET/C#, Java, ASP, ASP.net, VHDL, VB, Windows, Unix, Ladder Logic, RSLogix, CX-Programmer, CoDeSys, WinCC, Step 7, OLE, OPC, Algorithms, Optimization

EDUCATION

1994 PhD – Robotics and Automation, The University of Texas at Austin
1990 MSME – Biomedical Engineering, The University of Texas at Austin
1985 BSEE – Instrumentation and Computer Engineering, Rice University

EMPLOYMENT HISTORY

SafeMachines, PLLC November 2003 – Present

Founder and Principal Engineer

- SafeMachines is a registered, professional engineering services company specializing in collaborative robotics, computer-based automation, and electro-mechanical systems. Dr. Hooper is the professional engineer in responsible charge for engineering work and has ultimate responsibility for success of projects.
- Engineering customers include Applied Materials, Hiller Measurements, Intel, Schlumberger, Canon Micro, and Concurrent Design.
- SafeMachines also provides litigation support services to leading US and global law firms in the areas of patents, intellect property, contracts, and liability. Dr. Hooper has testified at deposition and in court more than two dozen times, including US district court and at the International Trade Commission.

Textron Incorporated, Electronic Systems Division

Chief Engineer August 2004 – September 2014

- Architect of WaveCore ADT product line - WaveCore ADT introduced condition-based maintenance, advanced analytics, FPGA-based control and asset management to automatic test systems. In addition to inventing and architecting the product line, I secured internal IRD & Capital funding to bring the product to market and published two IEEE papers promoting the product. I also led the successful effort to CE mark the WaveCore product line
- Architect of Canard Loader product line - This unique product deploys a four-axis, dual-loop servo control system to cancel inertial effects in the drive train and deliver a pure torque to aircraft control surfaces

Engineering Department Manager

- Achieved 97% on-time delivery against original contract PO delivery dates
- Achieved perfect scores during last two AS9100 audits of the engineering department
- Developed and formalized parametric estimation techniques for predicting engineering, manufacturing and material handling efforts

Hardware Engineering Manager

- Managed engineering resources to meet cost goals and reduce profit leakage to less than 3% profit degradation in aggregate across all projects
- Managed department to deliver work on schedule for 90% of tasks performed across all projects and proposals with metrics
- Developed department engineers through mentoring, training, and growth-oriented task assignment. Added professional development activities to official yearly review metrics

Program Technical Lead

- Ultimate responsibility for technical success of projects
- Lead engineer on successful projects for Medtronic, Guidant, Cameron Health, Northrop Grumman, Lockheed Martin, QLogic, Merrimac, Raytheon, Coherent and Freightliner

Fusion Technologies; Austin, Texas October 2003 – August 2004

Senior Software Architect

- Technical lead of team starting Austin office for this ten-year-old software company
- Set strategies, goals and milestones for office
- Grew office from zero to six customers in first nine months

Trilogy Development Group; Austin, Texas November 1998 – Oct. 2003

Senior Software Architect

- Owner of technical delivery at all Fortune 500 pricing customers
- Inventor and architect of Promotion Manager™ application
- Created optimization algorithms for pricing and promotion software
- Lead developer for contract and pricing management applications
- Instructor for Pricer Manager™ training classes
- Delivered customer success at Whirlpool, Michelin, Eaton and Merck
- Optimized query structure for 100X performance improvement at Michelin

- Designed database structure for query optimization of very large (>10^8 rows) tables

Eaton Semiconductor Equipment; Austin, Texas April 1997 – November 1998

Principal Engineer

- Led team of software, mechanical and electrical engineers as manager of major machine productivity project
- Designed a 3-axis programmable logic controller with electrical isolation, analog electronics, A/D, D/A and digital electronics
- Solved a complex resonance problem that had plagued the primary product line for years
- Robotics lead on 300mm product development

The Robotics Research Group; Austin, Texas January 1994 – April 1997

Deputy Director

- Managed multi-million dollar projects with the Department of Energy and NASA
- Managed 30+ graduate engineers
- Managed 16,000 sq. ft. laboratory with clean room, metrology and two-story high bay

Chief Scientist

- Conducted independent research with more than $1.25 million in research funds
- Developed advanced software for real time optimization, fault-tolerant control, operation in radiation fields, tool performance relationships, man/machine interfaces, servo motion control and PLC-based systems
- Developed hardware and software for a 2-axis programmable logic motion controller
- Developed 5-axis programmable logic motion controller for AC motors
- Taught robotics & automation, instrumentation and technical writing courses
- Guest lecturer at ITESM University in Mexico City, Mexico and The Institute For Robotics in Dortmund, Germany

Electro Cube Inc.; Los Angeles, California May 1986 – September 1987

Electrical Engineer

- Designed an instrument that measured current on the order of 10^{-9} amps and included an auto-calibration circuit
- Designed a tuned-oscillating electronic ballast for fluorescent tubes on aircraft
- Supported production machinery

Platt-Hardin Inc.; Houston, Texas May 1985 – May 1986

Electrical Engineer

- Designed and supervised the manufacture of synchronous motor controllers for the City of Houston
- Designed and developed a temperature controller for a heat-treating oven
- Supported production equipment

Methodist Hospital; Houston, Texas May 1984 – August 1984

Instrumentation Engineer

- Designed instrument for inducing pressure changes during balloon angioplasty
- Assisted development of instruments for measuring blood flow using ultrasound

TECHNICAL PUBLICATIONS

R. Hooper, “Where Are All the Robots?” Invited essay in “Robots: A Reference Handbook,” ABC-CLIO, 2018.

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R. Hooper, D. Shuffield, K. Merchant, D. Savage. “Common RF Test Platform.” IEEE Autotestcon 2011. September 12, 2011.

R. Hooper. “Optimal Switching Architecture for Automated Test Equipment.” IEEE Autotestcon 2011. September 12, 2011.

R. Hooper, W. Guy, R. Perrault. “A Current-Controlled Variable Inductor.” IEEE Instrumentation & Measurement Magazine. August 2011. Volume: 14, Issue: 4, Pages: 39 – 44.

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“R. Paulson, R. Hooper. “nvSRAM Improves Robotic System Safety.” Industrial Embedded Systems, Volume 3, Number 2, 2007, Pages: 24-30.

C. Cocca, D. Cox, D. Tesar, R. Hooper. “Failure Recovery in Redundant Serial Manipulators.” Proceedings of The World Automation Congress 2000 (WAC 2000). IEEE SMC, June 2000.

R. Hooper. “A Simulated Annealing Optimization Algorithm Implemented Within an Operator-Assist Interface.” IEEE International Conference on Robotics and Automation, Volume 1, 1997, Pages: 656 – 661.

R. Hooper, M. Noakes. “Kinematic Control Models for Teleoperation of Redundant Robots.” American Nuclear Society Seventh Topical Meeting on Robotics and Remote Systems. April 1997, Augusta, Georgia.

R. Hooper. “Using Telescience to Share NASA Resources During the Classroom Study of a Mars Sample and Return Mission.” 1997 ASEE/GSW Annual Conference, March 1997, Houston, Texas.

D. Tesar, R. Hooper. “Summary Report – Fault Tolerant Robotic Architectures and Adaptive Control.” NASA Grant Number NAGG-411, April 1997.

M. Pryor, C. Kapoor, R. Hooper, D. Tesar. "A Reusable Software Architecture for Manual Controller Integration." IEEE International Conference on Robotics and Automation, 1997.

R. Hooper, C. Kapoor. "Motion Coordination for Redundant Robots by Tracking Position-Level Equality Constraints." IEEE International Conference on Robotics and Automation, 1996, Silver Spring, Maryland.

R. Hooper, D. Tesar, D. Sreevijayan, J. Geisinger, C. Kapoor. "A Four-Level Mechanical Architecture for Fault-Tolerant Robots." Journal of Reliability Engineering and System Safety, Volume 53, Number 3, 1996, Pages: 237-246.

R. Hooper, C. Kapoor, D. Tesar. "Decision Making Software for Dual-Arm Operations in Nuclear Facility Decontamination and Dismantlement." Proceedings of the World Automation Congress (WAC), Montpellier, France, 1996. Concurrently published in the Proceedings of the International Symposium on Robotics and Automation (ISRAM), Albuquerque, New Mexico, 1996.

R. Hooper, "A Number of Simulated Robot Applications." 1996 IEEE International Conference on Robotics and Automation." April 1996, Video Proceedings.

R. Hooper, S. Sreenivasan. "Using Telescience to Enrich Engineering Education." University of Texas Academic Development, September 1996.

C. Kapoor, N. Pettus, R. Hooper, D. Tesar." Computer Considerations for Advanced Robotics." Proceedings of The 1996 ASME Design Engineering Technical Conferences and Computers in Engineering Conference, Irvine, California, August 18-22, 1996.

C. Kapoor, N. Pettus, R. Hooper, D. Tesar. "Hardware and Software Considerations for Advanced Robotics." Proceedings of The 1996 Symposium on Ship Building, 1996, San Diego, California.

D. Tesar, J. Chladek, R. Hooper, D. Sreevijayan, C. Kapoor, J. Geisinger, M. Meaney. G. Browning, K. Rackers. "Advanced Development for Space Robotics with Emphasis on Fault-Tolerance." 29th Aerospace Mechanism Symposium, May 17-19, 1995.

R. Hooper, D. Tesar. "Motion Coordination Based on Multiple Performance Criteria with a Hyper-Redundant Serial Robot Example." Proceedings of the 1995 IEEE International Symposium on Intelligent Control, 27-29 Aug. 1995, Pages: 133 – 138.

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D. Tesar, R. Hooper. "Final Report – U.S. Department of Energy Nuclear Energy University Program in Robotics for Advanced Reactors." Grant Number DE-FG02-86NE37966, April 1995.

R. Hooper. “Multicriteria Inverse Kinematics for General Serial Robots.” Thesis (PhD)—University of Texas at Austin, 1994.

R. Hooper, D. Tesar. “Computer-aided Configuration of Modular Robotic Systems.” Journal of Computing and Control Engineering, Volume: 5, Issue: 3, June 1994, Pages: 137 - 142.

R. Hooper, K. Diller. “A Musculotendon Model Suitable for Use in Neuromusculoskeletal Control Simulation.” International Conference on Bond Graph Modeling ICBGM'93, San Diego, SCS Publishing, Simulation Series, Vol.25, 1993, Pages: 333-338.

R. Hooper, D. Tesar, G. Browning. “Generalized Inverse Kinematics for N Degree-of-Freedom Robot Manipulator.” Robotics and Machine Perception, February 1993, Page: 5.

R. Ambrose, D. Tesar, R. Hooper. “An Experimental Investigation of Robot Actuator Performance.” Proceedings of the Second International Symposium on Measurement and Control in Robotics, November 1992, Pages: 623 – 630.

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R. Hooper. “The Interactive Assembly and Computer Animation of Reconfigurable Robotic Systems.” Thesis (M.S. in Engineering) -- University of Texas at Austin, 1990.